ATTACHMENT VI-1

GROUNDWATER FIELD SAMPLING PLAN

This plan outlines the procedures relating to groundwater sample collection, sample preservation, sample shipment, analytical procedures, chain of custody controls, equipment calibration, quality assurance, and quality control. This plan satisfies the requirements of UAC R315-8-6.8(d) and (e).

1. Sample Collection

   a. Prior to sampling, the Permittee shall perform the following:

      i. Begin a Groundwater Sampling Sheet (EC-0150) and prepare a complete set of sample containers for each well;

      ii. Check the monitoring well for proper identification; and

      iii. Check the wellhead for any signs of tampering or damage;

      iv. A Photo Ionization Detector (PID) or Flame Ionization Detector (FID) shall be used to detect the presence of volatile organics in the air, in close proximity to the groundwater. Measurements are taken at two locations and the results are recorded on the Groundwater Sampling Sheet (EC-0150). The first reading shall be taken at the wellcap immediately upon opening. The second reading shall be taken from a point near the groundwater exiting the effluent tube as the first water is being pumped from the well. If volatile organic vapors are measured at 10 parts per million or greater, the sample team shall don respirators to complete sampling of the well.

   b. All samples shall be collected in new, and certified clean (by manufacturer), sample containers provided by the analytical laboratory.

   c. The Permittee shall label each container submitted for analysis with the following information:

      i. Project name and location (well number);
      ii. Field sample identification;
      iii. Date and time sample was collected;
      iv. Preservative (if applicable);
      v. Sampler's initials; and
      vi. Analysis type.

d. The Permittee shall perform depth to groundwater measurements prior to each sampling event and total well depth measurements on an annual basis during the first sampling event of each calendar year at each monitoring well.

i. Depth to groundwater measurements shall be performed as follows:

A. The water level probe shall be rinsed with distilled or de-ionized water and inspected for any foreign material.

B. A straight edge or framing square shall be placed across the top of the protective well casing and the water level probe lowered into the well until either the audible or visual alarm activates. Two consecutive readings shall be obtained and one recorded in the Field Sampling Logbook.

ii. If the measured water column is less than 90 percent of the theoretical water column, the monitoring well shall be redeveloped prior to sampling.

iii. Total well depth measurements shall be performed using an electric water level indicator as follows:

A. Prior to measuring the total depth of each well, the dedicated pumps shall be extracted from the wells.

B. The condition of each pump shall be checked and any maintenance shall be performed to ensure proper operating conditions of the pumps.

C. The measurement shall be made from a surveyed reference location at the top of the protective casing.

D. A straight edge shall be placed across the open protective casing and measurements shall be determined from the bottom of the straight edge.

E. Prior to insertion into the well casing, the Permittee shall triple rinse the electric water level probe with distilled or de-ionized water and inspect for foreign matter to ensure proper decontamination.

F. The Permittee shall lower the probe slowly into the well until it is in contact with the bottom of the well.

G. The depth to the bottom of the well shall be determined by

observing the place on the water level indicator's line at the bottom of the straight edge when the probe indicates it is at the bottom of the well.

H. Depths to the bottom of the well measurements shall be recorded in the Field Sampling Logbook.

iv. The Permittee shall add a correction factor to each measurement. The correction factor represents the distance from the depth to water sensor (where the measuring tape is referenced) to the end of the steel probe (which contacts the bottom of the well).

v. The measured water column shall be compared to the theoretical water column (based on monitoring well completion diagrams) to evaluate the amount of silt that has accumulated in the bottom of the monitoring wells using the following equation:

$$\text{Percent Actual Water Column} = \frac{(Td_m - DTW)}{(Td_t - DTW)} \times 100$$

where: Td_m is the measured well depth
Td_t is the theoretical well depth
DTW is the measured depth to water

vi. All data collected shall be recorded on the Groundwater Elevation Measurement Form (EC-98270). The Permittee shall also maintain a Field Sampling Logbook consisting of a weather resistant, bound, survey-type book, with non-removable, numbered pages. The logbook shall be updated on a daily basis (during fieldwork) and shall include the following information:

A. Name of individual making entry;
B. Personnel on site;
C. Date and time groundwater elevations were started and completed;
D. Weather conditions;
E. Monitoring well number;
F. Name and location of job;
G. Name and address of field contact person;
H. Equipment used for groundwater elevation measurements; and
I. Any concerns or problems.

e. Pre-Sampling Purging

i. The Permittee shall purge a minimum of three casing volumes of groundwater using a dedicated bladder pump to ensure samples are representative of the aquifer by performing the following:

A. The height of the water column in the well shall be determined by measuring the static water level and the total well depth according to 1.d. of this Attachment.

B. The volume of water to be purged from the monitoring well shall be calculated using the height of the water column in the well casing using the following formula:

Total Purge Volume: $V_t = 3(V_c) \times 7.48 \text{ gal/ft}^3$

where: V_t = Total Purge Volume (gallons)
V_c = Volume of water in well casing (ft^3)

Casing Volume: $Vc = \pi r_1^2 h_1$

where: V_c = Casing Volume (ft^3)
r_1 = Inside radius of monitoring well casing (ft)
h_1 = Height of water column (i.e., total well depth minus static water level depth) (ft)

C. If there is insufficient groundwater recharge to evacuate three casing volumes from the well, the Permittee shall evacuate the well to dryness and then sample after the well has recovered to 80 percent of the static water level.

D. If the well becomes dry before all sample containers are filled, then the remaining sample containers shall be filled after the well recharges sufficiently.

E. Purge volume calculations and the actual purge volume removed from each well shall be recorded on the Groundwater Sampling Sheet (EC-0150).

ii. To ensure the groundwater samples are representative of the aquifer, the Permittee shall monitor the following parameters using a flow-through cell during pre-sampling purging:

A. Specific conductivity (SC);
B. pH;
C. Temperature;
D. Dissolved oxygen (DO); and

E. Reduction/oxidation (redox) potential (Eh).

iii. Before sampling is initiated, a minimum of three casing volumes shall be purged from the well and three consecutive water quality measurements shall meet the following criteria:

A. Specific conductivity = ± 3 percent;
B. pH = ± 0.1 units; and
C. Temperature = ± 1°C.

iv. All of the water quality measurements listed in d.iii above shall be documented on the Groundwater Sampling Sheet (EC-0150). The appearance of the discharge water shall also be documented.

v. Purge water evacuated from the monitoring wells shall be containerized and placed in either the Decontamination Pad Tank System or one of the Evaporation Tanks in accordance with Condition VI.E.3.A.

f. Environmental Samples

i. Groundwater samples shall be collected directly into the appropriate sample container from the discharge line of the dedicated bladder pump.

ii. For all samples, the sample bottles shall be filled in the order of compound volatility or stability as follows:

A. Volatile Organics;
B. Toxicity (TOX);
C. Total Organic Carbon (TOC);
D. Semi-Volatile Organic Compounds (SVOCs);
E. Dioxins/furans (if required)
F. Metals (unfiltered)/Inorganics;
G. Total Dissolved Solids (TDS), Total Suspended Solids (TSS);
H. Sulfides;
I. Cations/Anions; and
J. Radiological Compounds.

iii. For groundwater samples collected for VOCs from the bladder pumps, the discharge rate of the pump shall be reduced to the EPA recommended rate of approximately 100 milliliters per minute during sample collection.

iv. The Permittee shall provide at least one VOA pour blank for each cooler containing samples for VOC analysis, one set of replicates representing 10% of the total number of samples, one laboratory blank, and one VOA trip blank for analysis for each sampling event.

2. Sample Preservation and Shipment

a. Immediately after sample collection, the Permittee shall place sample containers in a cooler containing ice and chilled to 4°C.

b. Preservatives shall be added according to the analytical method applicable for each sample.

c. All groundwater samples shall be packaged on the day of collection in coolers containing ice. Transport or shipment to the laboratory shall occur on the day of collection.

d. In the event the samples require shipping, the following procedures shall be followed for packing samples:

i. Samples shall be placed upright in a waterproof metal (or equivalent strength plastic) ice chest or cooler provided by the laboratory.

ii. Ice shall be placed in double Ziploc™ bags or equivalent (to prevent leakage) and arranged around, among, and on top of the sample bottles. Sufficient ice shall be used so samples will reach and maintain a temperature of approximately 4°C.

iii. The cooler shall be filled with inert cushioning material, such as shipping peanuts, additional bubble pack, or cardboard dividers to prevent the sample containers from sliding during shipment.

iv. The Permittee shall place the completed Chain of Custody (COC) form (EC-0100), in a waterproof plastic bag and tape it to the inside of the cooler lid.

v. The Permittee shall secure the cooler lid with strapping tape by wrapping it completely around the cooler.

vi. The Permittee shall sign and date custody seals and place them on the cooler in two locations across the opening of the cooler lid.

3. Analytical Procedures

a. Samples shall be analyzed in accordance with Condition VI.E.3.c.

4. Chain of Custody Controls

a. Chain of custody (COC) procedures provide an accurate written record of the possession of each sample from the time of collection in the field through laboratory analysis. A sample shall be considered in custody if one of the following applies:

i. It is in an authorized person's immediate possession,

ii. It is in view of an authorized person after being in physical possession,

iii. It is in a secure area after having been in physical possession of an authorized field person,

iv. It is in a designated secure area, restricted to authorized laboratory personnel only.

b. Chain of Custody Field Procedures

i. The sample custody and documentation procedures shall be initiated at the time of sample collection.

A. Sample collection details shall be documented on the Groundwater Sampling Sheet (EC-0150).

B. Samples shall be labeled and the appropriate information shall be recorded on the COC (EC-0100).

C. All entries shall be made in indelible ink.

D. Any errors shall be corrected by drawing a single line through the incorrect entry, entering the correct information, and then initialing and dating the change.

ii. Properly completed COC records shall ensure that sample custody is documented, appropriate sample fractions have been collected, and scheduled analyses are properly assigned.

iii. Custody seals shall be placed in two locations across the cooler closure to ensure that any tampering is detected. The date and initials of the sample shall be written on the custody seal.

iv. Laboratory Custody Procedures.

A. Upon receipt in the laboratory, the integrity of the shipping container shall be checked by verifying that the custody seal is not broken.

B. The cooler shall be opened and examined for evidence of proper cooling.

C. The sample containers shall be checked for breakage, leakage, damage, and the contents and analytical requirements of the shipment shall be verified against the COC.

D. Custody seal integrity, the temperature blank, and sample preservation shall be checked.

E. If a problem is identified, it shall be documented on the COC and the Permittee shall be notified at the time of receipt.

F. Any shipping receipts shall be attached to the COC records and stored in the project file.

G. A permanent logbook shall be maintained in the sample control area to document the following:

(1) Date of sample receipt
(2) Sample number
(3) Number of samples
(4) Source of samples

H. Sample custody shall be maintained within the lab's secure facility until sample disposal has been recorded in the sample logbook. Any marks or notes made on the COC by the laboratory shall be clearly distinguishable from original field notation.

5. Equipment Calibration

Field equipment used during groundwater sampling shall be calibrated as outlined below. Results shall be documented on the Groundwater Monitoring Field Instrument Calibration Sheet (EC-2975).

a. Water-Level Sounder. The electric water-level sounder shall be checked before the beginning of field activities to ensure that it is in good working order. The sounder shall be checked for overall appearance (cleanliness, cuts in the tape) and the sounder probe shall be submerged in water to check for operation. Annually the Permittee shall calibrate the water-level sounder against a steel surveyor's tape. The calibration shall be made at room temperature and adjustments may be made based on calibration results. Calibration results and adjustments if required shall be documented.

b. Water Quality Parameter Meters. Any meter used for water quality parameter measurements shall be calibrated using reliable commercial reference standards or solutions in accordance with the manufacturer's instructions.

i. pH Meter. Three buffer standards (4, 7, and 10) shall be used for pH meter calibration.

ii. Specific conductance meter. Two buffer standards (10,000 and 100,000 µmhos/cm) shall be used for calibration.

iii. Calibration shall occur prior to use or at any time a meter drift is suspected.

iv. Calibration shall also occur during the middle of the day and at the end of the day.

c. Photoionization Detector (PID) or Flame Ionization Detector (FID). The PID or FID shall be calibrated on a daily basis during the sampling event with a standard (isobutylene, span gas or other calibration chemical) to ensure that the instrument is functional.

6. Quality Assurance and Quality Control

a. The Permittee shall provide VOA pour blanks, laboratory blanks, and trip blanks for the purpose of quality assurance/quality control in accordance with Module VI of this Permit.